**13. Pac-Man**

# Program Name: Pacman.java Input File: pacman.dat

Pac-Man is an arcade game. In this problem you will be creating a simulation of Pac-Man.

**Mechanics**

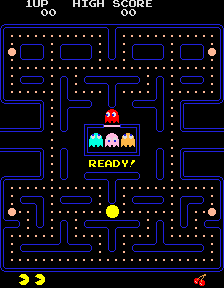
In the game Pac-Man, the player controls Pac-Man. The goal of the game is to move around the map and collect all the yellow pellets without dying. In the map there are also 4 ghosts that each move with a preprogrammed algorithm; if Pac-Man touches a ghost, he will die. The ghosts start in a small area in the center of the map and are released one at a time.

On the map there are also 4 power pellets. If Pac-Man eats a power pellet, the ghosts will change their algorithm for some time. During this time, Pac-Man is able to eat ghosts and gain points by doing so.

For this exercise, it does not matter if Pac-Man can collect all the yellow pellets. The only goal of this simulation is to ensure Pac-Man stays alive. If, by the end of controller input, Pac-Man has not yet died, then the simulation is considered successful. Otherwise, it is considered a failure.

**Map**

The map looks like this:



And can be represented in text format with the following:

############################

#............##............#

#.####.#####.##.#####.####.#

#O####.#####.##.#####.####O#

#.####.#####.##.#####.####.#

#..........................#

#.####.##.########.##.####.#

#.####.##.########.##.####.#

#......##....##....##......#

######.#####.##.#####.######

######.#####.##.#####.######

######.##.....G....##.######

######.##.########.##.######

######.##.# #.##.######

#.........# #.........#

######.##.# #.##.######

######.##.########.##.######

######.##..........##.######

######.##.########.##.######

######.##.########.##.######

#............##............#

#.####.#####.##.#####.####.#

#.####.#####.##.#####.####.#

#O..##........P.......##..O#

###.##.##.########.##.##.###

###.##.##.########.##.##.###

#......##....##....##......#

#.##########.##.##########.#

#.##########.##.##########.#

#..........................#

############################

Where

# represents a wall

. represents a space where Pac-Man can freely move

O represents a power pellet

G represents a ghost’s starting position

P represents Pac-Man’s starting position

**Pac-Man’s Movement**

The controller input has four directions: Up, Down, Left, or Right. Pac-Man will only occupy one space at a time. Pac-Man cannot move into a wall; if a controller input would make him go that direction, nothing will happen. Pac-Man also cannot turn around unless he is at an intersection or a dead end (e.g. he is facing a wall).

Pac-Man dies whenever he either moves into the same square as a ghost, or swaps squares with a ghost. When Pac-Man touches a power pellet, he will not die when he interacts with a ghost for the next 12 turns. Additionally, any ghost he interacts with during this period will disappear for 3 turns then respawn at G.

**Ghost Movement**

Each ghost has a different algorithm for moving around the maze. For the purposes of this exercise, we will assume that Blinky will leave the starting point at the beginning, Pinky will leave 12 turns after Blinky, Inky will leave 12 turns after Pinky, and Clyde will leave 12 turns after Inky. A ghost always moves to the left when first leaving the starting point. When a ghost is eaten by Pac-Man with a power pellet, it will wait for 3 turns before respawning.

Ghost movement has 3 states. When a ghost spawns, it will first enter scatter mode for 10 turns. During scatter mode, Blinky, Pinky, Inky and Clyde travel with shortest path to the top right, top left, bottom right, and bottom left tiles respectively. If two directions are equidistant from a target tile, a ghost will prioritize upward movement first, then left, down and finally right. Note that, like Pac-Man, ghosts cannot turn around unless they are facing a wall. Additionally, ghosts cannot turn around by 180 degrees at any time during scatter mode. After entering scatter mode, each ghost will enter chase mode.

During chase mode, the ghost’s target tile is determined using a target tile that is calculated differently depending on Pac-Man’s position. Blinky’s target tile is Pac-Man’s location. Pinky’s target tile is four indices ahead of Pac-Man, in the direction he is facing. Inky’s target tile is the position in which the line created by his target position and Blinky’s current position is bisected by Pac-Man’s current position. Clyde’s target tile is the same as Blinky’s, unless he is 8 positions or closer from Pac-Man, in which he will revert to scatter mode until he is more than 8 positions away from Pac-Man.

Finally, frightened mode is only activated when Pac-Man eats a power pellet. When frightened mode is first activated, all ghosts will immediately make a 180 degree turn. During frightened mode, all ghosts will find Pac-Man’s tile and move away from it. Frightened mode lasts for 12 turns. After the 12 turns, all ghosts will immediately make a 180 degree turn and revert to the mode they were in before being coerced into frightened mode.

If a ghost’s target tile is inaccessible due to walls or some other reason, they will continue to move in the most appropriate direction. A ghost will never stop moving unless it is not spawned.

**Input**

The input will consist of an unknown number of lines. On each line, there will be a single character: U, L, D, or R, which signify a controller input of up, left, down, or right respectively. Each line represents one turn.

**Output**

If Pac-Man is alive by the end of the inputs, output ALIVE. Otherwise, output DEAD.

**Example Input File**

L

L

L

L  
D  
D  
R

R  
D

L  
L

L

L  
L  
U

U

R

U

L

U

U  
R

R  
R

R

U  
U

U

U

**Example Output to Screen**

ALIVE